

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)**

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INTERNATIONAL APPLICATION NO.  
PCT/EP99/03723

INTERNATIONAL FILING DATE  
May 28, 1999

PRIORITY DATE CLAIMED  
May 28, 1998

TITLE OF INVENTION

Method and Device For Producing Plastic Hollow Bodies, and Plastic Hollow Bodies Produced Therewith

APPLICANT(S) FOR DO/EO/US

Dietmar PRZYTULLA and William LIMA

Applicant herewith submits to the United States Designated/ Elected Office (DO/EO/US) the following items under 35 U.S.C. 371:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is transmitted herewith (required only if not transmitted by the international Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureaus.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
  - a) International Search Report, dated September 30, 1999, in English and German (2 pages each) (with IDS, item 11)
  - b) First page of published application, WO 99/61219
  - c) Formal Drawings (9 sheets, Figs. 1-18)

- 17.
- ☒
- The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees as follows:

CLAIMS				
(1)FOR	(2)NUMBER FILED	(3)NUMBER EXTRA	(4)RATE	(5)CALCULATIONS
TOTAL CLAIMS	19 - 20	0	X \$ 18.00	\$ 0.00
INDEPENDENT CLAIMS	3 - 3	0	X \$ 78.00	0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$ 260.00	\$ 260.00
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): <b>CHECK ONE BOX ONLY</b>				
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482)			\$ 670	
<input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))			\$ 760	
<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO			\$ 970	
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2) to (4)			\$ 96	
<input checked="" type="checkbox"/> Filing with EPO or JPO search report			\$ 840	\$ 840.00
Surcharge of \$130.00 for furnishing the National fee or oath or declaration later than 20 30 mos. from the earliest claimed priority date (37 CFR 1.492(e)).				
TOTAL OF ABOVE CALCULATIONS				= 1,100.00
Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (Note 37 CFR 1.9, 1.27, 1.28).				- \$ 0.00
SUBTOTAL				= 1,100.00
Processing fee of \$130.00 for furnishing the English Translation later than 20 30 mos. from the earliest claimed priority date (37 CFR 1.492(f)).				+
TOTAL FEES ENCLOSED				\$ 1,100.00

- a. ☐ A check in the amount of \$\_\_ to cover the above fees is enclosed.
- b. ☒ Please charge Deposit Account No. 16-1150 in the amount of \$ 1,100.00 to cover the above fees. A copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 16-1150. A copy of this sheet is enclosed.

- 18.
- ☐
- Other instructions
- 
- n/a

- 19.
- ☒
- All correspondence for this application should be mailed to
- 
- PENNIE & EDMONDS LLP
- 
- 1667 K STREET, N.W.
- 
- WASHINGTON, D.C. 20006

- 20.
- ☒
- All telephone inquiries should be made to (202) 496-4720

Harry C. Jones, III  
NAME

SIGNATURE

20,280

REGISTRATION NUMBER

Feb. 29, 2000

DATE

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

U.S. National Phase of  
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Group Art Unit: to be assigned

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Serial No.: to be assigned

For: METHOD AND DEVICE FOR  
PRODUCING PLASTIC HOLLOW  
BODIES AND PLASTIC HOLLOW  
BODIES PRODUCED THEREWITH

Filed: Herewith

Inventors: Dietmar PRZYTULLA et al.

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Please amend the above-identified application as follows, with reference to the  
English translation, with line numbering added.

IN THE SPECIFICATION:

Page 1, line 4, delete "Prior Art" and insert --BACKGROUND OF THE  
INVENTION--.

Page 2, line 18, delete "The Objective" and insert --SUMMARY OF THE  
INVENTION--.

line 25, delete "The Solution".

Page 4, line 12, delete "The Benefits of Ribbing";

before line 29, insert --BRIEF DESCRIPTION OF THE  
DRAWINGS--.

Page 5, line 18, insert --DETAILED DESCRIPTION OF THE INVENTION--.

#### IN THE CLAIMS

Please amend the claims as follows.

1.[D] (Once Amended) Method for producing blow-molded plastic hollow bodies, whereby a moldable, hot tubular parison blank of a thermoplastic material is extruded from the adjustable circular nozzle of an extruder system and is introduced between the open blow-mold halves of a blow-mold in which, upon closing of the blow-mold, the parison blank is expanded into a finished hollow body with the aid of a gaseous pressure medium [(compressed air)], while during the extrusion of the parison blank [-] the wall thickness of the extruded parison is increased over its length by means of a first control element on the adjustable circular nozzle of the extruder system, [-] and a partly differing wall thickness of the extruded parison over its circumference is obtained in at least two different longitudinal zones [(near the ultimate pinch-off edges perpendicular to the parison)] by means of a second control element on the adjustable circular nozzle of the extruder system,  
[**characterized in that**] wherein:

[-] custom profile contouring in the form of a third thick/thin wall-thickness setting of the extruded parison is obtained at preselectable points along its length and/or its circumference by means of a third control element on the adjustable circular nozzle of the extruder system.

2.[D] (Once Amended) Method as in claim 1, wherein:

[**characterized in that**]

[-] the wall thickness of the extruded parison is progressively increased over its length by the slow and progressive widening of the cross section of the nozzle with the aid of the first said control element[.];

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[-] the wall thickness of the extruded parison in at least two different longitudinal regions [(near the ultimate pinch-off edges perpendicular to the parison)] is partially increased over its circumference, with the aid of the second control element, by a corresponding enlargement of the cross section of the nozzle, whereby additional plastic material is fed in [(no displacement),]; and

[-] the thick/thin contouring of the parison wall thickness, producing longitudinal ribs, is obtained with the aid of the third control element by the engagement of an adjustable nozzle gate valve DS II, having a serrated tooth/interstitial-gap profile, for a partial, lateral displacement of the plastic material in the nozzle gap.

3.D] (Once Amended) Method as in claim 1, wherein  
**[characterized in that]**

[-] the wall thickness of the extruded parison is progressively increased over its length by the slow, progressive widening, with the aid of the first control element, of the cross section of the nozzle[.];

[-] the wall thickness of the extruded parison in at least two different longitudinal regions [(near the ultimate pinch-off edges perpendicular to the parison)] is partially increased over its circumference, with the aid of the second control element, by a corresponding enlargement of the cross section of the nozzle, whereby additional plastic material is fed in [(no displacement),]; and

[-] the parison wall thickness is partially increased by means of an additional thickening capability whereby, with the aid of the third control element opening an adjustable nozzle gate valve DS II with a custom-contoured profile, the cross section of the nozzle is partially enlarged so as to feed in additional plastic material [(no displacement)], forming at least one additional thick spot in at least one preselectable location along the length and/or circumference of the parison.

4.D] (Once Amended) Device for producing blow-molded plastic hollow bodies, incorporating an extrusion die for extruding a tubular parison blank and an adjustable annular parison exit nozzle with circular nozzle/mandrel-gap control elements (D 0, DS I) which permit a specifically targeted setting of the nozzle gap for modifying the wall thickness of the exiting parison blank, comprising:

**[characterized in that]**

at least three separate, differently contoured, exchangeable nozzle/nozzle-gap control elements (D 0 = mandrel, DF, DS I, DS II) [are provided] which, from within and/or from outside the nozzle gap, can be individually and/or simultaneously caused to engage in the extruded parison, with at least two of the control elements (D 0 = mandrel, DS I, DS II) being adjustable for which purpose they are equipped with separate adjustment drives.

5.[D)] (Once Amended) Device as in claim 4, wherein

**[characterized in that]**

the third, additional control element (DS II) serving to produce a custom-contoured profile, [(such as a serration or a thick spot)], is situated underneath the control element (DS I) and engages in the exiting parison [als] along the last element modulating the wall thickness.

6.[D)] (Once Amended) Extrusion die as in claim 4 or 5, wherein

**[characterized in that]**

the bottom-most inner edge of the third control element (DS II) which can be engaged in the exiting parison, is positioned at approximately the same level or slightly above the bottom-most outer edge of the central mandrel (D 0).

7.[D)] (Once Amended) Hollow body, consisting of a thermoplastic material, comprising:

**[characterized in that]**

at least in the axial wall regions, as measured [(in the direction of the parison)], multiple, mutually spaced ribs [are formed] only on the inside of the wall while the outside of the wall retains [its] a uniformly smooth surface.

8.[D)] (Once Amended) Hollow body as in claim 7, wherein:

**[characterized in that]**

mutually neighboring wall zones are of an alternately different wall thickness, with [the] transitions from the thinner to the thicker wall zones and vice versa [are] formed on the inside of the wall in undulating fashion in a uniformly increasing and decreasing wave pattern.

9.[]] (Once Amended) Hollow body as in claim 7 or 8, wherein:

**[characterized in that]**

[it] the body is produced by the blow-molding method, whereby a tubular parison blank extruded from an extrusion nozzle is expanded in a blow mold, with an appropriate nozzle-control setting progressively and uniformly increasing the wall thickness of the parison blank in its axial direction, while by means of a corresponding nozzle control the parison sections exposed to the highest stress factors are provided with a greater wall thickness for the container regions of the top and bottom panels extending at a 90° angle to the mold-parting plane, and that, by means of an appropriate nozzle control, internal and/or external longitudinal ribs are produced on the tubular parison blank in such fashion that the finished blow-molded container, obtained in a blow-mold with a smooth surface for the lateral or vertical wall sections, is provided with parallel, mutually neighboring, strip-like wall zones of a varying wall thickness at least on the vertical container walls extending in the axial direction.

10.[]] (Once Amended) Hollow body as in claim 7 or 8, wherein

**[characterized in that]**

[it] the body is produced by the blow-molding method, whereby a tubular parison blank extruded from an annular extrusion nozzle is expanded in a blow-mold, with an appropriate nozzle-control setting progressively and uniformly increasing the wall thickness of the parison blank in its axial direction, while by means of a corresponding nozzle control the parison sections exposed to the highest stress factors are provided with a greater wall thickness for the container regions of the top and bottom panels extending at a 90° angle to the mold-parting plane so as to obtain in the finished blow-molded hollow body a virtually identical wall thickness, and that by means of an appropriate third nozzle control element the parison blank is provided at least in part with an additional augmentation of the wall thickness so as to obtain in the axial or vertical wall of the finished blow-molded hollow body, through the introduction of an additional amount of plastic material, a thick region for instance for a lateral bung fitting on a plastic fuel container (KKB) or, in the case of an upright-format canister (Fassett), for a lateral handle or carrying-handle attachment.

11.[D] (Once Amended) Hollow body as in claim 7, [8, 9 or 10,] wherein:

**[characterized in that]**

the thicker, strip-shaped wall regions are equally thick and the thinner, strip-shaped wall regions are equally thin.

12.[D] (Once Amended) Hollow body as in [one of the preceding claims 7 to 11,] claim 7,  
wherein:

**[characterized in that]**

the thinner wall region between two ribs is at least about twice or several times as wide as a rib.

13.[D] (Once Amended) Hollow body as in [one of the preceding claims 7 to 12,] claim 7,  
wherein:

**[characterized in that]**

the ratio between the height (= wall thickness) of the raised areas A (= rib, wave crest) and the thinner wall regions B (wave trough) is  $A(H) : B(H) = 1.1 : 1$  to  $1.5 : 1$ .

14.[D] (Once Amended) Hollow body as in [one of the preceding claims 7 to 13,] claim 7,  
wherein:

**[characterized in that]**

the number of ribs for a container diameter of approximately 23" (590 mm) is between 20 and 60 and is preferably about 32.

15.[D] (Once Amended) Hollow body as in [one of the preceding claims 7 to 14,] claim 7,  
wherein:

**[characterized in that]**

for rectangular containers, [(such as canisters)], each corner is provided with at least one or several ribs, with such ribs preferably extending upwards and/or downwards beyond the vertical wall toward and into the horizontal top and/or, respectively, bottom panels of the container.



16.[D] (Once Amended) Hollow body as in [one of the preceding claims 7 to 14,] claim 7,  
wherein:

**[characterized in that]**

for rectangular containers, [(such as canisters)], at least one or several ribs are formed into each straight wall section with the exception of the corners, with such ribs preferably extending upwards and/or downwards beyond the vertical wall toward and into the horizontal top and/or, respectively, bottom panels of the container.

IN THE ABSTRACT


Add the attached Abstract, as page 17, to the application.

REMARKS

The specification and claims have been amended to conform to U.S. practice. An action on the merits is respectfully requested.

Respectfully submitted,

Date February 29, 2000

  
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## 5

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**Method and Device for Producing Plastic Hollow Bodies, and**  
**Plastic Hollow Bodies Produced Therewith**

This invention relates to a method and a device for producing plastic hollow bodies, and to a plastic hollow body produced therewith.

Prior Art:

5 In the production of plastic hollow bodies such as cylindrical bung-equipped barrels or lid-top drums with an essentially circular lid or top surface, it is usually desirable to obtain a finished container with a consistent, uniform wall thickness, given that a thin or starved area will always constitute a weak spot of the container. This is a particular problem in blow-molding where the hot parison blank exiting from the extruder nozzle is automatically elongated or stretched as a function of its progressively greater length and weight, leading to a thinning of the wall thickness of the blank during the extrusion, while in the blow-forming process it is exposed to strongly varied stretch forces especially in the areas near the flash and shear edges perpendicular to the blank and at a 90° angle to the plane of separation of the blow mold. These inevitable phenomena are typically compensated for by correspondingly controlling the rate at which the parison blank exits the extruder nozzle. This, however, requires special ancillary equipment for the extruder, with dual adjustments for the annular extrusion nozzle as well as special techniques and control programs for sectional wall-thickness adjustment of the extruded parison in adaptation to the specific, varying container shape to be produced. A number of nozzle-control systems for sectional or partial wall-thickness control (PWDS) have been on the market.

10 The British patent 1.107.628 already describes a method and a device by means of which rib-shaped protrusions or, viewed in the circumferential direction, varying wall thicknesses can be molded into the extruded parison blank. The inside of the finished blow-molded hollow body is thus provided with reinforcing ribs extending in an axial direction. However, that earlier extrusion system does not permit other adjustments such as a progressive increase in the wall thickness of the parison as a function of its length.

25 Plastic containers intended for industrial use for the storage and transportation especially of hazardous substances require a special permit for which they must pass appropriate quality tests (such as cold drop tests, internal pressure tests, stacking load tests etc.). In the stacking load test the plastic containers are exposed to a progressively increasing pressure up to the point where the hollow-body buckles. The compressive load on the hollow body creates compression stress in the vertical side walls. That compression stress leads initially to a certain circumferential expansion and then, if there is excessive stress in the areas which cannot expand outwards, to an inward buckling.

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5 The stacking load will cause the wall areas close to the bottom to bulge (so-called elephant foot), changing the transitional radius between the vertical wall and the horizontal bottom. In practice, these manifestations of inadequate stacking strength in the form of buckling and bulging are often encountered when plastic barrels are stacked and especially when these are filled with hot liquids and immediately stacked in layers of three or four or when stacked for an extended time period.

10 The US patent 4.257.527 already describes a large-volume plastic barrel (having a capacity of 55 US gallons or about 208 liters) where the vertical wall area of the cylindrical body is reinforced by several longitudinal ribs (see fig. 4 thereof). These longitudinal ribs are produced in the blow-molding of a parison blank, having a constant, uniform wall thickness, merely by providing the blow mold with axial grooves. The thickness of the container wall in the circumferential direction remains unchanged. Where the longitudinal ribs, molded relatively deep into the container wall, transition into the upper and/or lower perimeter, this configuration causes deep pockets or nests from which highly viscous materials can be removed only with great difficulty, making the barrel unsuitable for multiple reuse. Moreover, these transition points at the perimeter constitute structurally weak spots in the event the barrel is exposed to a mechanical load.

15  
20 The Objective:

It is the objective of this invention to provide an improved method and a corresponding device for producing plastic hollow bodies, and especially plastic containers which, while retaining their smooth external wall surface and an unchanged operational container weight, i.e. without increasing the net material weight compared to that of a corresponding conventional container, offer greater stacking-load strength especially when filled with hot liquids.

25 The Solution:

30 The method applied according to this invention for producing blow-molded plastic hollow bodies in a blow molding tool incorporating an extruder, an extrusion die with a circular runner and an appropriate blow mold proper, whereby during the extrusion of the parison from the extrusion die the nozzle and mandrel gap are adjusted for a specifically targeted wall thickness of the extruded blank, is particularly characterized in that, through the sequential or simultaneous action of three differently profiled, separately adjustable nozzle/mandrel-gap control elements, it is possible to obtain thickness/thinness settings which vary in controlled, selectable fashion over the circumference and length of the parison blank. This multiple adjustability of the extrusion is of great significance for large-volume industrial containers (for instance 220-liter barrels), it is unique at this juncture and unmatched in terms of the quality of the containers.

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5 The containers thus produced, having vertical walls, an essentially horizontal top panel or clampable lid, including at least one filler and drain opening, and a corresponding bottom panel, are provided exclusively on the inside of their vertical walls with multiple, mutually spaced ribs, leaving the exterior wall surface uniformly smooth and unchanged. Plastic barrels configured in this fashion offer visibly improved stacking strength while not in any way complicating their handling (e.g. gripping by barrel loaders, or lateral rolling of the barrel).

10 The implementation of this invention provides for alternating variations of the thickness of neighboring wall sections, with the transitions from thinner to thicker wall sections and vice versa being in the form of uniformly decreasing and increasing waveforms on the inside of the wall. In a preferred embodiment the wall thickness of all the thicker, strip-like wall regions is the same and the thinner, strip-like wall regions are of an identically reduced thickness.

15 The plastic container according to this invention is produced by blow molding, a process in which a parison blank extruded through a circular nozzle is expanded in a blow mold, whereupon, by means of correspondingly controlled nozzle settings, the blank is adjusted for a consistently increasing wall thickness in the axial direction while, again by appropriate nozzle control, the blank sections exposed to the highest stretch factors at the points of the top and bottom panels of the container which are located at a 90° angle relative to the separation plane are adjusted for a greater wall thickness and, again by appropriate nozzle control, the parison is provided on the inside and/or outside with longitudinally protruding ribs in such fashion that the finished product completed in a blow mold, having a smooth surface for the lateral i.e. vertical wall sections, is provided at least axially on the container wall with parallel, neighboring, strip-like wall regions alternating between a larger and a lesser thickness (a ribbed drum).

20 The new triple or multiple nozzle/mandrel-gap control elements according to this invention permit in advantageous fashion numerous new applications for large-volume, blow-molded plastic components of all types (e.g. motor-vehicle accessories and the like). When the third nozzle/gap control element DS II is suitably configured, the invention will lend itself particularly well to the production of industrial blow-molded components, including for instance top-quality plastic fuel tanks (KKBs) for the automotive industry.

25 The plastic container with reinforced vertical wall sections per this invention may be produced as an essentially sealed hollow body (for instance a bung-equipped barrel with two lateral bung holes, or a drum with screw-on lid = "L-ring HOT" with a larger screw-on cover), or an open-top hollow body with a cover lid and clamping ring (e.g. a standard lid-top barrel or a Vanguard FRH drum).

30 With the design per this invention, incorporating internal reinforcement ribs without otherwise changing the wall thickness obtained using two conventional control elements, it has been possible with great success for instance in the USA to fill hot liquids into lid-top barrels (Vanguard FRH drums, filling temperature of content about 180°F) having a barrel weight of about 22 lbs, to store the barrels

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for three days in a heat chamber at temperatures between 140 and 160°F and then stack them four-high, without observing any of the traditional signs of deformation.

The axial ribbing in the vertical wall regions increases the rigidity of the hollow body, i.e. the denting resistance of the barrel shell while the ribs along the axial radii in the transition from the wall to the top or bottom panel prevent a curling of the bottom corners. When hollow bodies with axial, longitudinal ribs per this invention are subjected to an axial load, the circumferential stress is evenly distributed. When filled with hot liquids, and after these have cooled off, Vanguard drums with ribbed wall reinforcement display substantially better resistance to negative pressure conditions. The exterior wall of the barrel, its smoothness unchanged, permits easy marking or labeling. It also allows for easy cleaning of the barrels and thus for multiple reuse.

#### The Benefits of Ribbing:

The ribs are formed by partially increasing the wall thickness. The thicker the ribs, the disproportionately greater the resistance of the hollow-body shell to kinking, bulging and buckling or to a curling of the bottom edges; indeed, the section modulus is augmented by a power of three as the height or thickness of the ribs increases.

The barrels and drums according to this invention do not have a greater operational net weight than conventional barrels; there is only a redistribution of the container wall material, in each case from a "thin strip" to an adjoining "thick strip" (= rib).

In the past, buckling, bulging or, respectively, the curling of the bottom edges of hollow bodies has been avoided by increasing the overall wall thickness of the container and thus its material net weight. In various embodiments in which the reinforcement ribbing is provided only on the inside of the hollow-body wall, the ribs may be configured as follows:

- in an axial direction over only a specific partial region or
- over the entire length or height of the cylindrical wall;
- along the radii, i.e. transitions from the vertical wall to the horizontal top or bottom panel;
- in the disc-shaped top and/or bottom panels.

This invention is explained in more detail in the following description of implementation examples with the aid of schematic drawings in which

- Figure 1 is a sectional cutoff view of an extrusion die according to this invention;
- Figure 2 is a schematic wall-thickness control program for a specifically targeted wall thickness setting for the extruded parison blank;
- Figure 3 shows a longitudinal section and three cross sections of a blank;
- Figure 4 shows a finished, blow-molded hollow body and its cross section;
- Figure 5 shows a partial cross section of a parison;

- Figure 6 shows a partial cross section of a rib-reinforced canister wall;  
 Figure 7 shows a partial cross section of a rib-reinforced barrel wall;  
 Figure 8 shows a longitudinal section of a rib-reinforced canister;  
 Figure 9 is a top view and a partial cross-sectional view of the canister per fig. 8;  
 Figure 10 shows a longitudinal section of another rib-reinforced canister;  
 Figure 11 is a top view and a partial cross-sectional view of the canister per fig. 10;  
 Figure 12 is a lateral view and partial cross-sectional view of a standard lid-top barrel with a rib-reinforced barrel wall;  
 Figure 13 shows two cross sections of the wall of the barrel per fig. 12;  
 Figure 14 is a lateral view and partial cross-sectional view of a Vanguard FRH lid-top barrel with a rib-reinforced wall;  
 Figure 15 shows two cross sections of the wall of the barrel per fig. 14;  
 Figure 16 is a lateral view and partial cross-sectional view of a sealed L-ring barrel with a rib-reinforced wall;  
 Figure 17 shows two cross sections of the wall of the barrel per fig. 16; and  
 Figure 18 is a perspective illustration of a plastic subcontainer for a pallet container, with rib-reinforced walls.

Figure 1 shows part of an extrusion die 10 with three adjustable nozzle/mandrel-gap control elements D0, DS I in conjunction with DF and DF II in the "nozzle gap open" mode, extruding a parison blank 22. Centered in the extrusion die 10 is an axially adjustable mandrel support 12 to the bottom of which a truncated-cone-shaped mandrel 14 is attached, in easily removable i.e. interchangeable fashion, as the first nozzle/mandrel-gap control element  $D_{null}$  ( $D_{zero} = D_0$ ). An enclosure 16 surrounds the extrusion die. The enclosure 16 houses a hollow-cylindrical reservoir 18 in which the molten plastic material fed from one or several extruders into the extrusion die is evenly distributed and stored. The reservoir 18 connects to a circular nozzle gap 20 the inside of which is delimited by the mandrel 14, i.e. by the first nozzle/mandrel-gap control element  $D_0$  while on the outside it is delimited by an enclosure-mounted nozzle/ring DF and two adjustable nozzle/mandrel-gap control elements, the nozzle gate valve 1 = DS I and the nozzle gate valve 2 = DS II. Like the adjustable mandrel 14, the two axially adjustable control elements DS I and DS II are attached to the extrusion-die enclosure in easily detachable and thus interchangeable fashion. The axial setting and precise positioning of the adjustable nozzle/mandrel-gap control elements may be operated for instance by a hydraulic mechanism or by electric motors such as small servo motors. The enclosure-mounted nozzle ring DF as well is attached to the extrusion-die enclosure in easily removable and interchangeable fashion, primarily to permit, at the time of a product changeover with attendant exchange of the blow-mold

halves, an equally quick exchange of the appropriately contoured, product-specific circular runners and nozzle-gap control elements.

In the extrusion die 10 illustrated in fig. 1, the nozzle/mandrel-gap control elements are in the "nozzle gap open" mode, meaning that the mandrel D 0 is lowered a certain distance, the nozzle gate valve = control element DS I is in its bottom-most position and the gate valve DS II is not all the way up. Corresponding arrows indicate the respective available path lengths for the adjustment of the control elements. In the extrusion die 10, the surfaces of the gap-delimiting fixed nozzle/circular runner DF and the control element DS II are contoured while the gap-delimiting surfaces of the mandrel D 0 and the control element DS I are completely smooth.

In the operating mode shown, the nozzle gap 20 is delimited on the outside by the lower, inner, smooth edge of the nozzle gate valve DS I and on the inside by the axially adjustable mandrel 14. The extruded parison 22 has a uniformly thin circumference. The contouring profiles of the fixed nozzle/circular runner DF and of the control element DS II are not engaged in their active position. To engage the contouring profile of the nozzle/circular runner DF, one simply moves the gate valve DS I with its smooth lower edge in an upward direction. To fully engage the serrated profile of the gate valve DS II, the gate valve DS II can be lowered a certain distance. The circular serration, in this case with evenly spaced teeth 24 and interstitial spacings 26, is outlined in the marginal illustration. When the serration engages circumferentially in the exiting parison, the teeth 24 displace the extruded plastic material sideways into the adjoining interstitial spaces 26.

To engage the fixed, enclosure-mounted circular runner DF, the control element DS I and the control element DS II are jointly moved upward a certain distance (see arrow), preventing these two control elements from engaging in the extruded parison blank 22. The die gap 20 is now delimited by the mandrel 14 and the fixed, contoured circular runner DF. At this point the parison 22 exiting from the nozzle gap will no longer be of a uniform circumferential thickness but will be somewhat thinner in two mutually opposite regions (mold parting plane of the blow mold) than in the corresponding, 90°-shifted regions of the parison. This type of double-oval setting of the nozzle gap, or oval wall-thickness setting in mutually opposite regions of the parison, is typical for blow-molded blanks with flat top and bottom panels. In the process, the two mutually opposite regions of the parison having thicker walls are positioned between the open blow-mold halves in such fashion that they are formed into the horizontal container wall sections, situated at a 90° angle relative to the mold-parting plane, which are exposed to the largest stretch factors or expansion vectors of the plastic material. In other words, the purpose is to obtain a uniform wall thickness in the finished container, so that the corners of the container wall which are subjected to high stretch and strain levels are no thinner than the other wall sections.

The device (=extrusion die) according to this invention permits the selection of different, partly overlapping settings for varying wall thicknesses of the parison blank, thus compensating for the



process-related shortcomings inherent in blow-molding and achieving in the finished product (container or hollow body) as consistent and uniform a wall thickness as possible with an overlay of evenly spaced longitudinal ribs (reinforcing ridges).

5 This invention introduces a novel process whereby the two conventional measures used to achieve a uniform wall thickness in the finished blow-molded hollow body are complemented by an additional, third step which makes it possible to produce containers whose hollow bodies are provided with targeted, intentional and reproducible irregular wall-thickness patterns. Different variations of embodiment of the extrusion die according to this invention are described in more detail in the parallel  
10 PCT Application PCT/EP99/01398 filed by the same claimant.

Figure 2 is a schematic illustration of a wall-thickness control program for a specifically targeted wall thickness setting over the length of the extruded parison. Shown on the left are the individual programs a), b) and c) for the control elements D 0, DS I and DS II; in the center a parison wall of the extruded blank; and on the far right the blow-molded product in the form of a tilted L-ring barrel 28 with the flash sections 30 not yet removed.

In program a), the gate valve D 0 i.e. axially adjustable mandrel 14, serves to slowly and progressively open up the cross section of the nozzle so as to obtain a continuously progressive increase of the wall thickness over the length of the parison blank 22. In program b), the second control element, i.e. the gate valve DS I in conjunction with the contoured, enclosure-mounted circular nozzle ring DF, serves to set a partly larger circumferential wall thickness in the two longitudinal sections of the extruded blank (near the ultimate flash pinch-off perpendicular to the blank) by a corresponding enlargement of the cross section of the nozzle as additional plastic material is fed in (no displacement). In program c), the third control element i.e. adjustable gate valve DS II with the serrated-contour profile serves to select an alternating thick/thin wall-thickness pattern, creating longitudinal ribs by the partial, lateral displacement of the plastic material in the nozzle gap. The result, as illustrated in the center, is a strongly varied wall-thickness pattern over the length of the parison, the pattern being adapted to the respective type of product (in this case an L-ring drum with ribbing in the vertical wall section).

30 In contrast to conventional control elements by means of which the partly thicker parison sections intended for the highest stress points are produced by pushing aside plastic material in the nozzle gap for those parison sections which are moved into the mold-parting plane, whereby the displaced material is pushed into the thick-wall sections at a 90° angle to the mold-parting plane, the design of the extrusion device according to this invention, allowing the gate valve DS I to be moved upward,  
35 frees up the double-oval profile of the fixed nozzle ring DF, so that at that point more plastic material can flow where it is really needed. A lateral displacement over great path lengths has its

disadvantages in that the memory effect of the plastic material will negatively affect the straight flow of the parison, causing the cross section of the blank at its starting point to be out of round. When the initial point of the parison is not cleanly fed over the blowing mandrel and the parison-expanding mandrel, it will lead to frequent jamming of the system.

To more clearly illustrate a custom profile, the top part of Figure 3 shows a longitudinal section, the bottom part three cross sections, of a simplified parison blank 22 for a nonstandard blow-molded hollow body in the form of a plastic fuel container (KKB) 34. The parison blank 22 is thicker on top along the line A-A than it is at the bottom along line C-C. For simplicity's sake, the partially thicker, beaded areas obtained in sub-program b) by means of the gate valve DS I are not shown. In the cross-sectional plane B-B, one single, additional bead 32 serves to accommodate a lateral opening and fitting in the finished container. The plastic fuel container 34, with lateral fitting 38, and with the flash sections 36 not yet removed, is illustrated in Figure 4, as a lateral view on the top and a cross-sectional view on the bottom.

The extrusion die according to this invention, with three separate adjustment control systems, is particularly suitable for producing these custom configurations with local material accumulations (as along line B-B in fig. 3) such as the one required for the KKB 34 in the area of the fitting (line D-D in fig. 4).

Figure 5 is a partly cross-sectional view of a parison blank 22 with evenly spaced external ribs 40. When this parison is expanded into a finished hollow body, the ribbed parison 22 will lie against the smooth inner wall of the blow-mold and the external ribs 40 will be defined in the inner wall of the finished hollow body. Figure 6 shows a corresponding section of a straight container wall 42 (for instance that of a canister or of the inner container of an IBC pallet container) with internal ribs 44. Figure 7 shows a corresponding partial section of a cylindrical container wall for a Vanguard lid-top barrel 46 with internal ribs 48.

Figure 8 is a partial cross-sectional view of an implementation example in the form of a canister 50 with internal ribs 44 along the level i.e. straight walls. The top view of this canister, in Figure 9, shows in the partial, sectional illustration that the axial ribs 44 transition over a short horizontal distance into the bottom of the canister, whereas there are no ribs in the corners of the canister. The axial ribs 44 serve to reinforce the straight wall sections against excessive bulging when there is a buildup of internal pressure in the canister.

In contrast thereto, the corners of the canister 52 depicted in Figure 10 are provided with suitable internal ribs 54. These corner ribs 54 can be seen in Figure 11 which is a partly sectional top view of

the corners; they enhance the stacking load capacity and reduce any curling ('elephant feet') of the corners of this type of canister.

Figure 12 shows a lid-top barrel 56 of the globally familiar standard type developed by Mauser in 1975. The vertical wall of the barrel body is provided with multiple, mutually spaced, strip-like ribs 58 which extend all the way into the convex areas of the barrel body. In Figure 13 the cross-sectional view in the left half of the diagram shows the barrel wall with the internal ribs 58 and in the right half of the diagram the barrel wall without ribs just above the barrel bottom.

Figure 14 is a side view of the preferred embodiment of a Vanguard FRH lid-top barrel 60 with the barrel body 62, the lid 64 and the clamping ring 66. On the inside wall only, the barrel body 62 is provided with multiple, parallel, strip-like ribs 68, while the outer surface of the wall is evenly smooth without any modification. Figure 15 is again a cross-sectional view showing in the left half of the diagram the barrel wall with internal ribs 68 and in the right half of the diagram the wall area without ribs just above the bottom of the barrel. The transversal line indicated in the barrel bottom represents the pinch-off weld 70 of the parison blank in the mold-parting plane of the blow-mold.

Figure 16 shows another implementation example in the form of a closed bung-type barrel 72 with two lateral bung fittings in the top panel and internal ribs 74 along the vertical walls. In L-ring barrels of this type, the internal ribs 74 shown in Figure 17 enhance the stacking-load strength of the barrel body especially when filled with hot liquids.

As the last implementation example, Figure 18 illustrates a plastic inner container 76 as used in pallet containers. The internal ribs 78 outlined on the flat walls reinforce these walls and prevent the walls of empty containers from caving in.

In a comparison for instance between a conventional plastic barrel having a net weight of 10 kg and a plastic barrel according to this invention, likewise with a net weight of 10 kg, the cross-sectional mass of the extruded parison will be identical for both. The only difference in the case of the plastic barrel according to this invention is that the plastic material is displaced from a thin section to the right and left and redistributed into the two neighboring thick sections or ribs. A key benefit of this invention lies in the fact that for a plastic barrel according to this invention the blow-mold employed in each case need not be modified in any way, retaining its smooth inner surface.

The diameter of a 55-gallon Vanguard lid-top barrel is approximately 23" (590 mm). The width of the thick strips or ribs is about 1" (25 mm), their wall thickness about 0.2" (5.0 mm); the thin strips, i.e.

those of a regular wall thickness, are about 2" (50 mm) wide and about 1/8" (3.2 mm) thick. The spacing or thin strip between two neighboring ribs should be at least twice or several times the width of a rib.

For a barrel diameter of 23" (590 mm) the preferred number of ribs is around 32. Containers with a smaller diameter should have fewer, containers with a larger diameter should have a larger number of internal reinforcing ribs. Optimal parameter selection can result in an improvement of the stacking load strength of the containers according to this invention, especially when filled with hot liquids, compared to conventional containers, by as much as 5% to 20%.

This invention is equally applicable to containers with a circular cross section and to containers with a rectangular cross section (such as large canisters and square containers).

In sealed bung-type barrels (such as L-ring barrels) where the upper perimeter of the barrel wall is provided with a solid handling ring (i.e. L-ring), the strip-like ribs along the vertical wall preferably extend only to just below the handling ring rather than into the L-ring or the top panel. The distance between the end of the ribs (i.e. tapering off of the thick region) and the handling ring should be between about 3/4" (20 mm) and 2-1/3" (60 mm).

For a large-capacity container, for instance a 58-gallon L-ring barrel, the wall thickness in the thin wall regions between the ribs should be about 0.078" (2 mm) to 0.14" (3.5 mm); the wall thickness of the ribs should be between about 1/8" (3 mm) and 1/4" (6 mm). At no point should the wall thickness be less than 0.078" (2 mm).

Viewed in the circumferential direction, the width of a rib should be about 0.2" (5 mm) to 0.8" (20 mm); the width of the thinner wall regions between the ribs should be about 0.8" (20 mm) to 3.2" (80 mm).

List of Reference Numbers

10	Extrusion die	50	Canister, straight
12	Mandrel support D 0	52	Canister corner
14	Mandrel, centered	54	Corner ribs (52)
16	Enclosure	56	Lid-top barrel, standard
18	Reservoir	58	Internal ribs (56)
20	Nozzle gap	60	Vanguard lid-top barrel
22	Parison blank	62	Barrel body
24	Serration tooth	64	Barrel lid
26	Interstitial space	66	Clamping ring
28	L-ring barrel	68	FRH ribs
30	Flash sections	70	Pinch-off weld
32	Thick region	72	Bung-type barrel
34	Plastic fuel container KKB	74	Internal ribs (72)
36	Flash sections	76	IBC inner container
38	Fittings	78	Internal ribs (76)
40	External ribs (22)		
42	Straight wall		
44	Internal ribs (42)		
46	Lid-top barrel body		
48	Internal ribs (46)		
			<u>Nozzle/mandrel-gap control elements:</u>
		D 0	Central mandrel
		D F	Enclosure-mounted contoured circular runner
		DS I	Gate valve I with smooth edge
		DS II	Gate valve II with contoured profile

Patent Claims

5 1.) Method for producing blow-molded plastic hollow bodies, whereby a moldable, hot tubular parison blank of a thermoplastic material is extruded from the adjustable circular nozzle of an extruder system and is introduced between the open blow-mold halves of a blow-mold in which, upon closing of the blow-mold, the parison blank is expanded into a finished hollow body with the aid of a gaseous pressure medium (compressed air), while during the extrusion of the parison blank

- 10 - the wall thickness of the extruded parison is increased over its length by means of a first control element on the adjustable circular nozzle of the extruder system,
- a partly differing wall thickness of the extruded parison over its circumference is obtained in at least two different longitudinal zones (near the ultimate pinch-off edges perpendicular to the parison) by means of a second control element on the adjustable circular nozzle of the extruder system,

**characterized in that**

- 15 - custom profile contouring in the form of a third thick/thin wall-thickness setting of the extruded parison is obtained at preselectable points along its length and/or its circumference by means of a third control element on the adjustable circular nozzle of the extruder system.

20 2.) Method as in claim 1,

**characterized in that**

- 25 - the wall thickness of the extruded parison is progressively increased over its length by the slow and progressive widening of the cross section of the nozzle with the aid of the first said control element,
- the wall thickness of the extruded parison in at least two different longitudinal regions (near the ultimate pinch-off edges perpendicular to the parison) is partially increased over its circumference, with the aid of the second control element, by a corresponding enlargement of the cross section of the nozzle, whereby additional plastic material is fed in (no displacement), and
- 30 - the thick/thin contouring of the parison wall thickness, producing longitudinal ribs, is obtained with the aid of the third control element by the engagement of an adjustable nozzle gate valve DS II, having a serrated tooth/interstitial-gap profile, for a partial, lateral displacement of the plastic material in the nozzle gap.

35 3.) Method as in claim 1,

**characterized in that**

- the wall thickness of the extruded parison is progressively increased over its length by the slow, progressive widening, with the aid of the first control element, of the cross section of the nozzle.
- the wall thickness of the extruded parison in at least two different longitudinal regions (near the ultimate pinch-off edges perpendicular to the parison) is partially increased over its circumference, with the aid of the second control element, by a corresponding enlargement of the cross section of the nozzle, whereby additional plastic material is fed in (no displacement),
- the parison wall thickness is partially increased by means of an additional thickening capability whereby, with the aid of the third control element opening an adjustable nozzle gate valve DS II with a custom-contoured profile, the cross section of the nozzle is partially enlarged so as to feed in additional plastic material (no displacement), forming at least one additional thick spot in at least one preselectable location along the length and/or circumference of the parison.

4.) Device for producing blow-molded plastic hollow bodies, incorporating an extrusion die for extruding a tubular parison blank and an adjustable annular parison exit nozzle with circular nozzle/mandrel-gap control elements (D 0, DS I) which permit a specifically targeted setting of the nozzle gap for modifying the wall thickness of the exiting parison blank,

**characterized in that**

at least three separate, differently contoured, exchangeable nozzle/nozzle-gap control elements (D 0 = mandrel, DF, DS I, DS II) are provided which, from within and/or from outside the nozzle gap, can be individually and/or simultaneously caused to engage in the extruded parison, with at least two of the control elements (D 0 = mandrel, DS I, DS II) being adjustable for which purpose they are equipped with separate adjustment drives.

5.) Device as in claim 4,

**characterized in that**

the third, additional control element (DS II) serving to produce a custom-contoured profile (such as a serration or a thick spot) is situated underneath the control element (DS I) and engages in the exiting parison as the last element modulating the wall thickness.

6.) Extrusion die as in claim 4 or 5,

**characterized in that**

the bottom-most inner edge of the third control element (DS II) which can be engaged in the exiting parison, is positioned at approximately the same level or slightly above the bottom-most outer edge of the central mandrel (D 0).

7.) Hollow body, consisting of a thermoplastic material,

**characterized in that**

at least in the axial wall regions (in the direction of the parison), multiple, mutually spaced ribs are formed only on the inside of the wall while the outside of the wall retains its uniformly smooth surface.

8.) Hollow body as in claim 7,

**characterized in that**

mutually neighboring wall zones are of an alternatingly different wall thickness, with the transitions from the thinner to the thicker wall zones and vice versa are formed on the inside of the wall in undulating fashion in a uniformly increasing and decreasing wave pattern.

9.) Hollow body as in claim 7 or 8,

**characterized in that**

it is produced by the blow-molding method, whereby a tubular parison blank extruded from an extrusion nozzle is expanded in a blow mold, with an appropriate nozzle-control setting progressively and uniformly increasing the wall thickness of the parison blank in its axial direction, while by means of a corresponding nozzle control the parison sections exposed to the highest stress factors are provided with a greater wall thickness for the container regions of the top and bottom panels extending at a 90° angle to the mold-parting plane, and that, by means of an appropriate nozzle control, internal and/or external longitudinal ribs are produced on the tubular parison blank in such fashion that the finished blow-molded container, obtained in a blow-mold with a smooth surface for the lateral or vertical wall sections, is provided with parallel, mutually neighboring, strip-like wall zones of a varying wall thickness at least on the vertical container walls extending in the axial direction.

10.) Hollow body as in claim 7 or 8,

**characterized in that**

it is produced by the blow-molding method, whereby a tubular parison blank extruded from an annular extrusion nozzle is expanded in a blow-mold, with an appropriate nozzle-control setting progressively and uniformly increasing the wall thickness of the parison blank in its axial direction, while by means of a corresponding nozzle control the parison sections exposed to the highest stress factors are provided with a greater wall thickness for the container regions of the top and bottom panels extending at a 90° angle to the mold-parting plane so as to obtain in the finished blow-molded hollow body a virtually identical wall thickness, and that by means of an appropriate third nozzle control element the parison blank is provided at least in part with an additional augmentation of the wall thickness so as to obtain in the axial or vertical wall of the finished blow-molded hollow body, through the introduction of an additional amount of plastic material, a thick region for instance for a lateral



bung fitting on a plastic fuel container (KKB) or, in the case of an upright-format canister (Fassett), for a lateral handle or carrying-handle attachment.

11.) Hollow body as in claim 7, 8, 9 or 10,

**characterized in that**

the thicker, strip-shaped wall regions are equally thick and the thinner, strip-shaped wall regions are equally thin.

12.) Hollow body as in one of the preceding claims 7 to 11,

**characterized in that**

the thinner wall region between two ribs is at least about twice or several times as wide as a rib.

13.) Hollow body as in one of the preceding claims 7 to 12,

**characterized in that**

the ratio between the height (= wall thickness) of the raised areas A (= rib, wave crest) and the thinner wall regions B (wave trough) is  $A(H) : B(H) = 1.1 : 1$  to  $1.5 : 1$ .

14.) Hollow body as in one of the preceding claims 7 to 13,

**characterized in that**

the number of ribs for a container diameter of approximately 23" (590 mm) is between 20 and 60 and is preferably about 32.

15.) Hollow body as in one of the preceding claims 7 to 14,

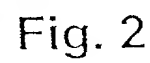
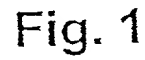
**characterized in that**

for rectangular containers (such as canisters) each corner is provided with at least one or several ribs, with such ribs preferably extending upwards and/or downwards beyond the vertical wall toward and into the horizontal top and/or, respectively, bottom panels of the container.

16.) Hollow body as in one of the preceding claims 7 to 14,

**characterized in that**

for rectangular containers (such as canisters) at least one or several ribs are formed into each straight wall section with the exception of the corners, with such ribs preferably extending upwards and/or downwards beyond the vertical wall toward and into the horizontal top and/or, respectively, bottom panels of the container.



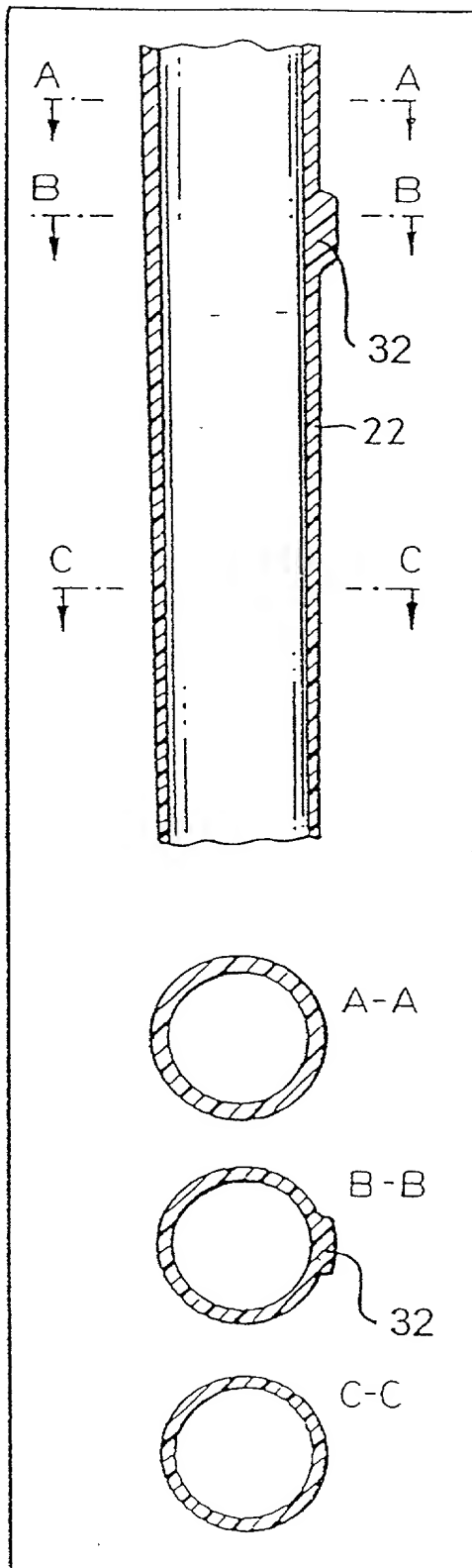


Fig. 3

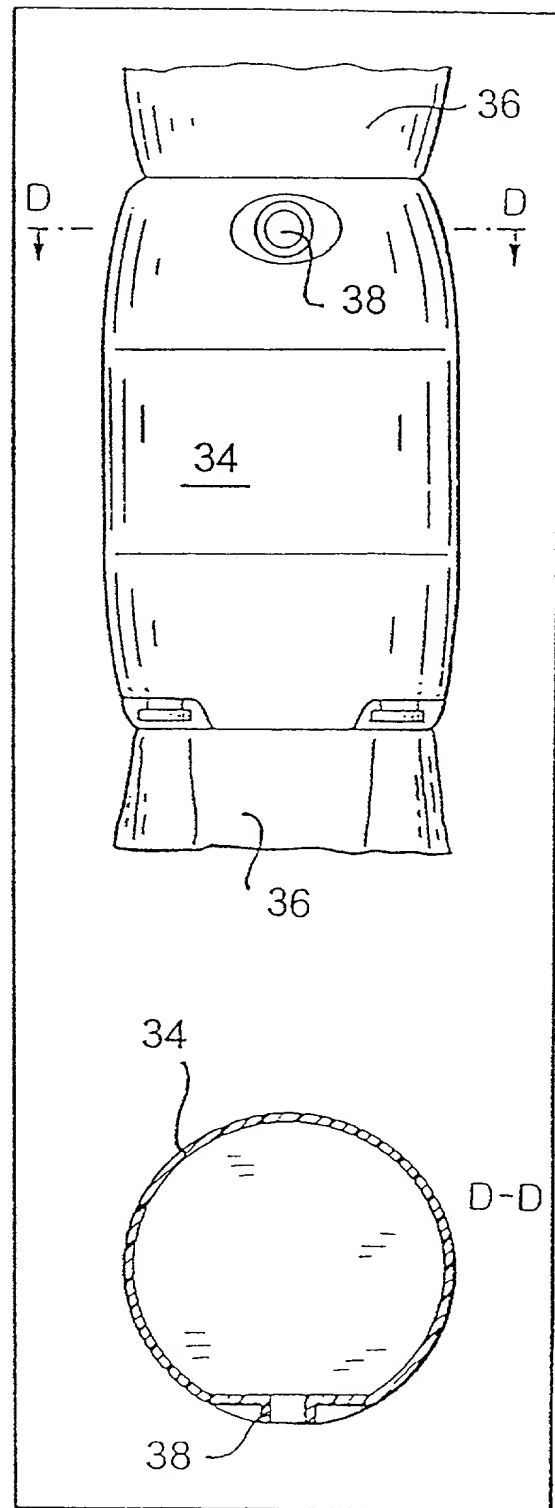
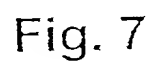
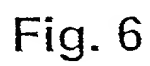


Fig. 4



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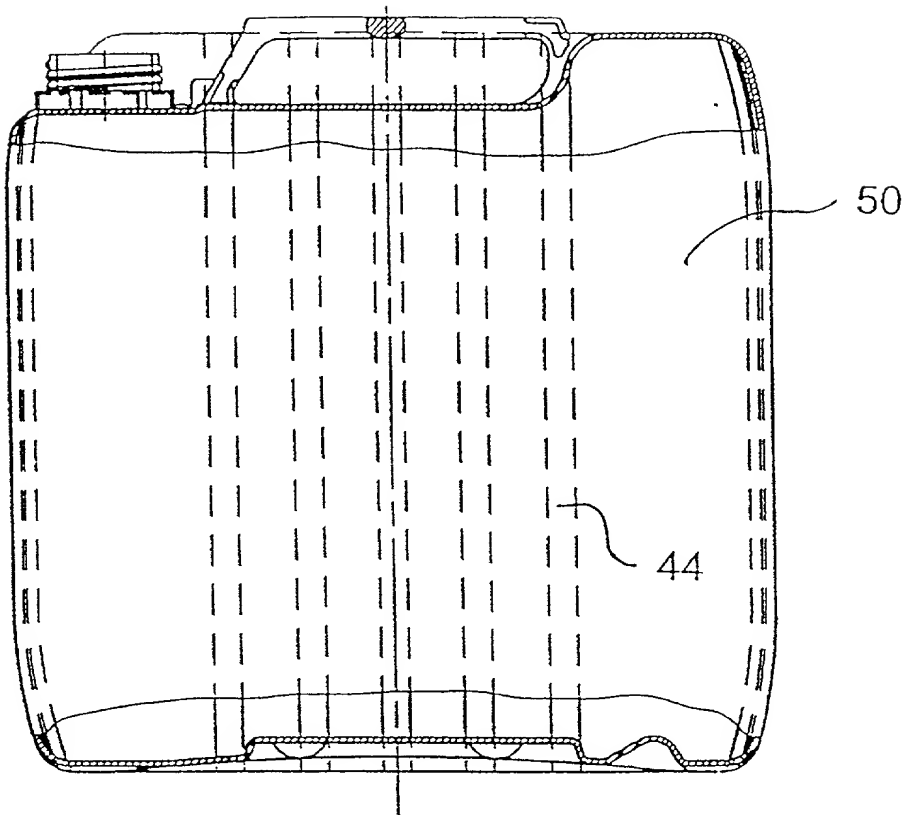


Fig. 8

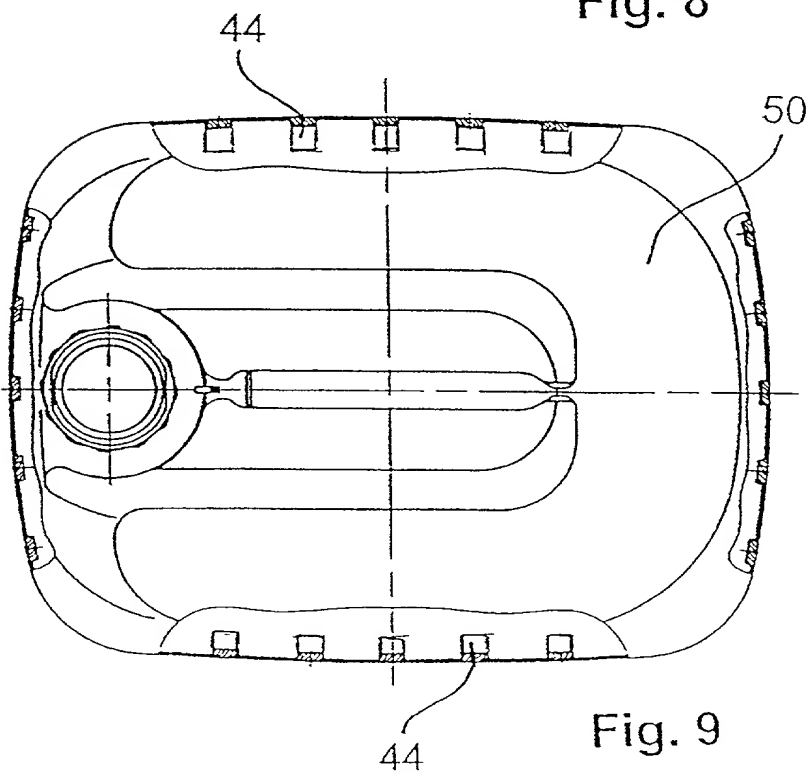


Fig. 9

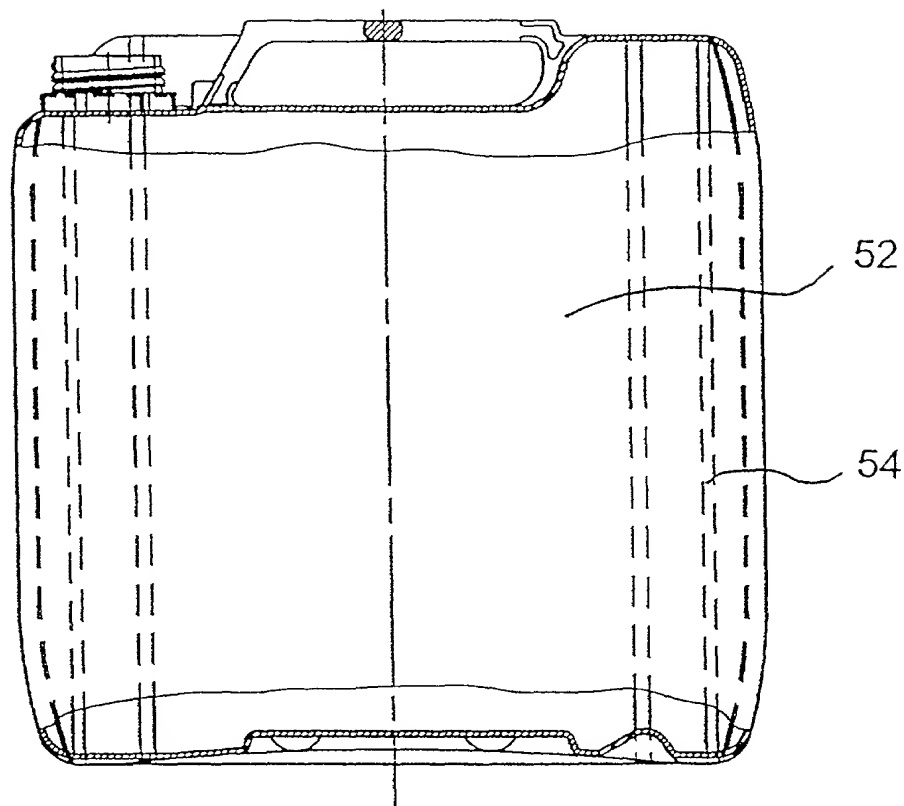


Fig. 10

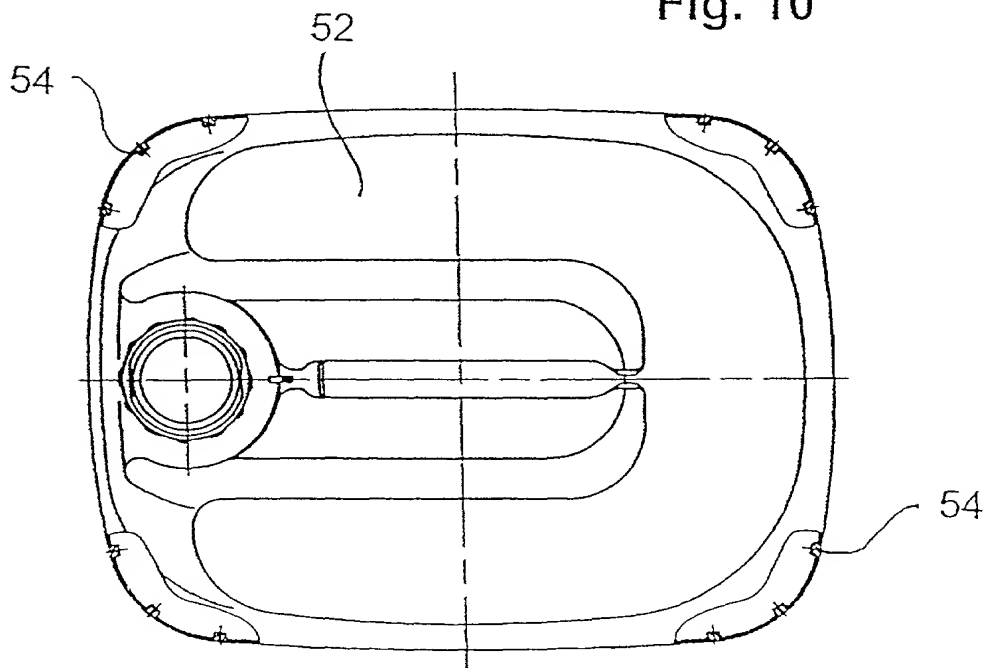


Fig. 11

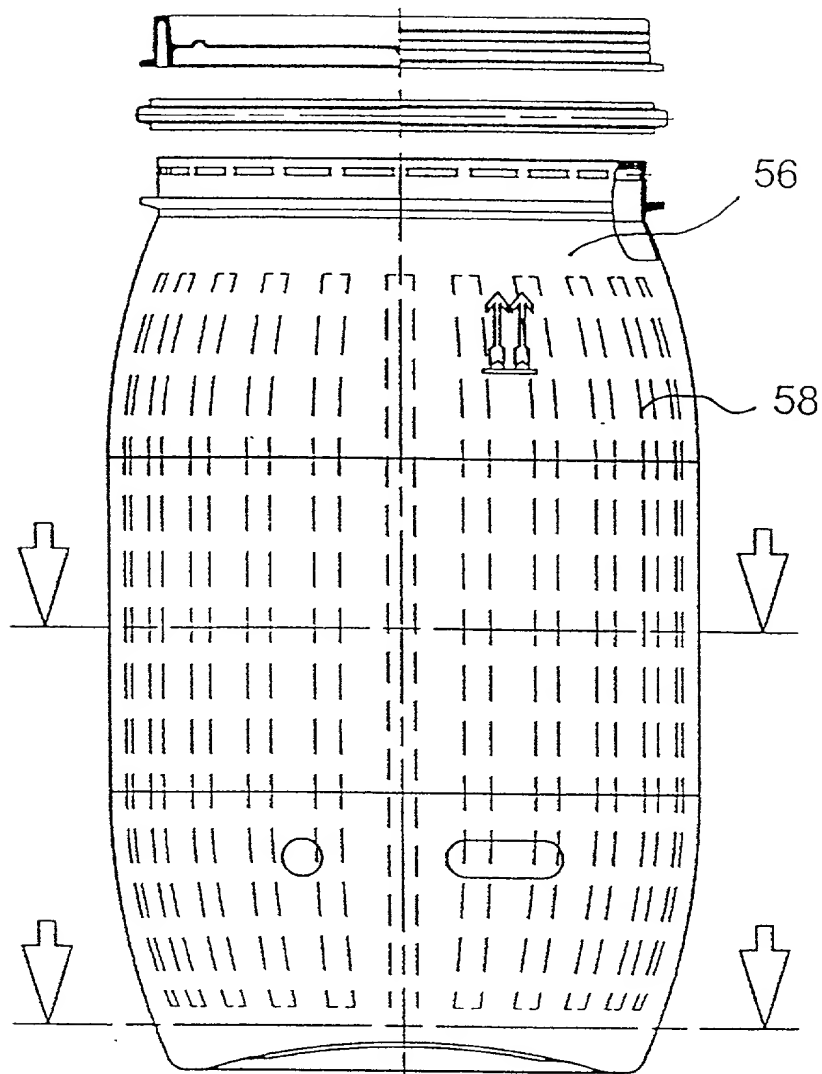


Fig. 12

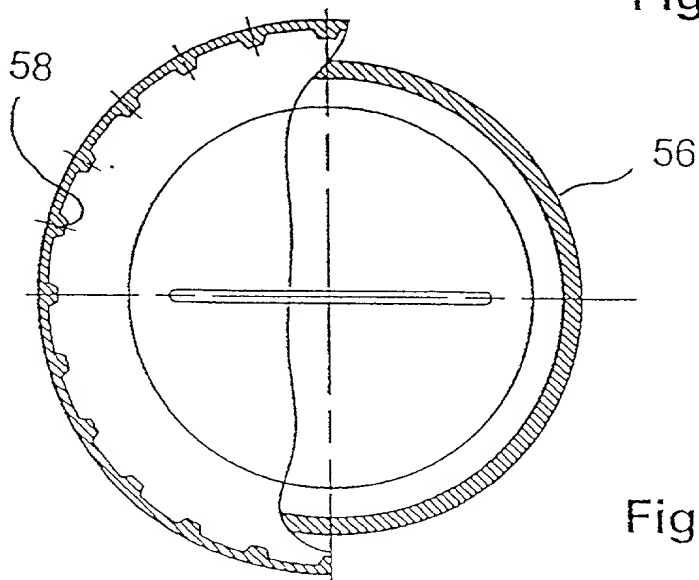


Fig. 13

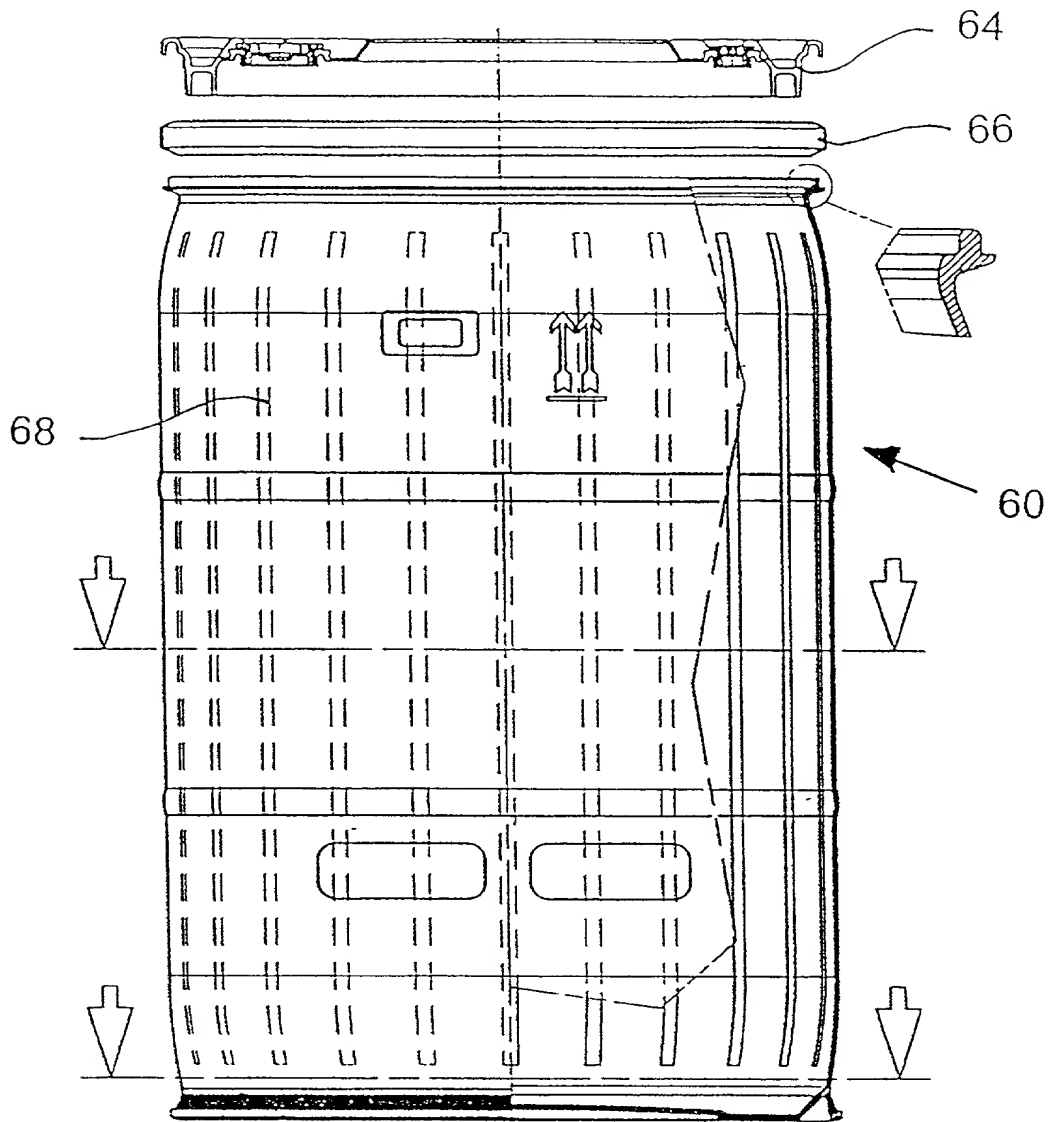


Fig. 14

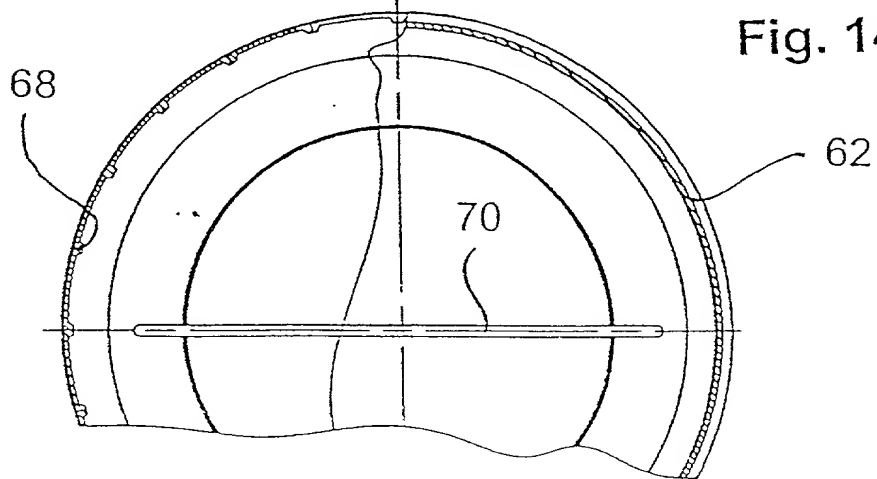


Fig. 15



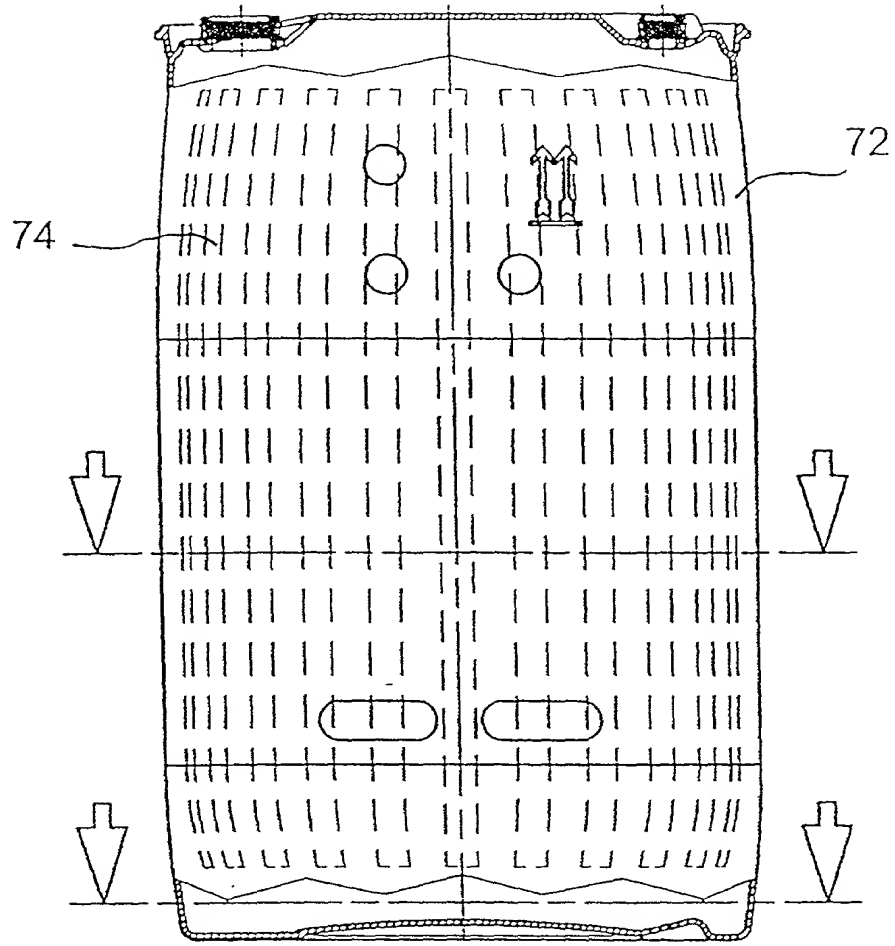


Fig. 16

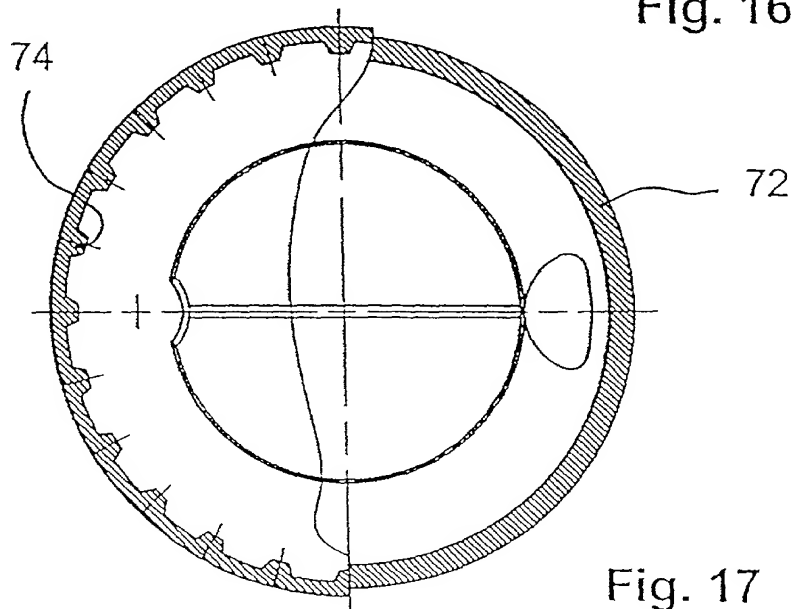


Fig. 17

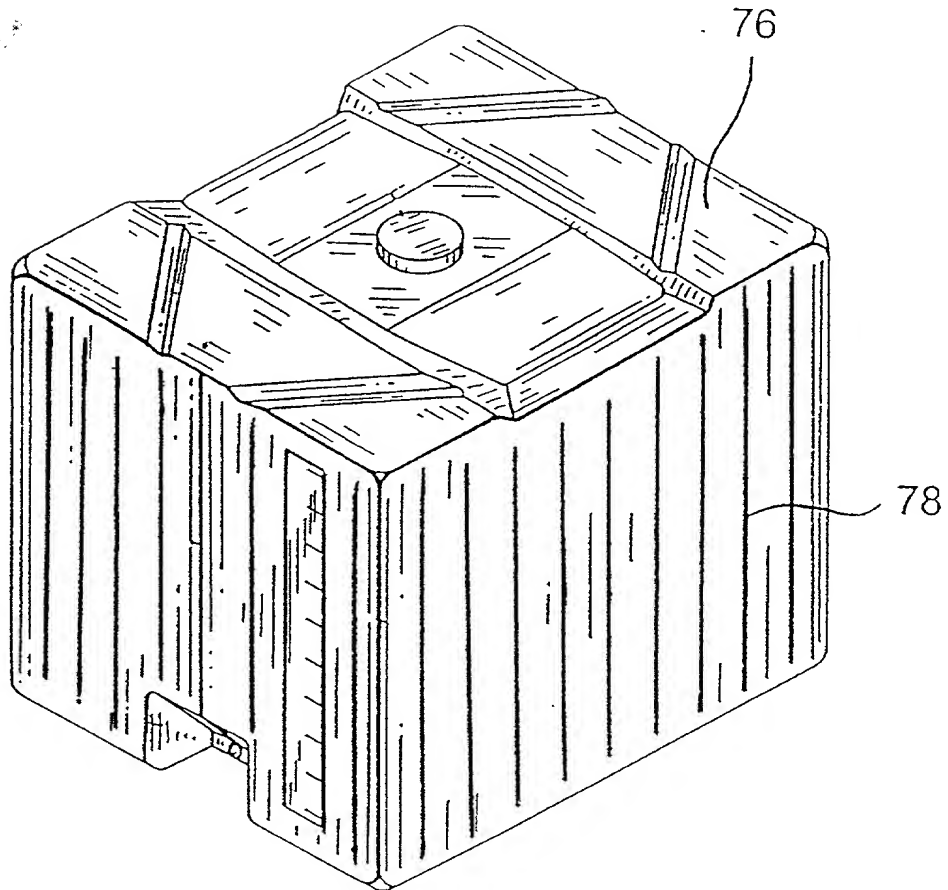


Fig. 18

# DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below at 201 et seq. underneath my name.

I believe I am the original, first and sole inventor if only one name is listed at 201 below, or an original, first and joint inventor if plural names are listed at 201 et seq. below, of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND DEVICE FOR PRODUCING PLASTIC HOLLOW BODIES, AND PLASTIC HOLLOW BODIES PRODUCED THEREWITH

and for which a patent application:

☒ is attached hereto and includes amendment(s) filed on *(if applicable)*

☐ was filed in the United States on as Application No. *(for declaration not accompanying application)*

with amendment(s) filed on *(if applicable)*

☒ was filed as PCT international Application No. PCT/EP99/03723 on 28 May 1999 and was amended under PCT Article 19 on *(if applicable)*

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED PRIOR TO THE FILING DATE OF THE APPLICATION			
APPLICATION NUMBER	COUNTRY	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
DE 298 09 489.4	Germany	28 May 1998	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
			YES <input type="checkbox"/> NO <input type="checkbox"/>

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below

APPLICATION NUMBER	FILING DATE
60/111,893	10 December 1998

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NO.	FILING DATE	STATUS		
		PATENTED	PENDING	ABANDONED

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon

SIGNATURE OF INVENTOR 201 <i>D. Przytulla</i>	SIGNATURE OF INVENTOR 202 <i>[Signature]</i>	SIGNATURE OF INVENTOR 203
DATE 6. FEBR. 2000	DATE Feb. 25, 2000	DATE
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DATE	DATE	DATE